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Report of the sixth session

ADVISORY COMMITTEE ON MARINE RESOURCES RESEARCH

Rome, 10—17 March 1971

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
ROME, 1971

REPORT OF THE SIXTH SESSION

OF THE ADVISORY COMMITTEE ON MARINE RESOURCES RESEARCH

Rome, 10 - 17 March 1971

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, June 1971

PREPARATION OF THIS REPORT

This is an edited and approved version of the Report of the Sixth Session of the Advisory Committee on Marine Resources Research (ACMRR: 6/71/W.P.28) as amended at the closing session. The approved version of the Report of the ACMRR Working Party on Fish Egg and Larval Surveys is being issued as a supplement to this main Report.

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I. GENERAL REPORT

1. PROCEDURAL MATTERS

1.1 Opening of the Session

The Chairman, Dr. C.E. Lucas, opened the Session and welcomed the members of the Committee and other participants. He recalled with deep regret the recent demise of two members of ACMRR, Dr. W.M. Chapman and Prof. J.T. Ruud, and that of Dr. Vernon Brock, former convener of an ACMRR working party; these, and other recent deaths, were a very heavy loss to marine science. The meeting observed a brief silence in their memory.

The Assistant Director-General (Fisheries), Mr. Roy I. Jackson, then welcomed all participants, especially the new members of ACMRR, on behalf of both the Director-General, who was absent from Rome, and the Department of Fisheries. He underlined the valuable contribution that ACMRR had made to international fishery and marine science activities through the recommendations adopted at its Fifth Session, as well as through various working parties. These activities had helped to achieve recognition of the need for long-term planning of international marine science activities and for closer collaboration between the UN Agencies concerned, particularly those members of ICSPRO and associated with IOC. The completion of the fisheries chapter of the Perspective Study of World Agricultural Development (PSWAD) (formerly Indicative World Plan), "The Fish Resources of the Ocean", also represented an important step toward the implementation of ACMRR's recommendations regarding the initiation of a world appraisal of marine resources, aimed mainly at achieving proper management of presently exploited resources and development of potential resources. In this connexion, Mr. Jackson considered the role of regional fisheries bodies to be of prime importance and emphasized that FAO activities in this field are based on the closest collaboration with these fisheries bodies. The Third UN Conference on the Law of the Sea, for which FAO is expected to provide technical and scientific information regarding fisheries, would provide an opportunity to further develop the role of regional fisheries bodies.

One of the most significant recent developments in the activities of FAO and other Specialized UN Agencies, that must be credited to the far-sighted initiative of ACMRR, was the recognition of the need for concerted international action in the field of marine pollution, in which FAO is now considered to have taken a leading role in connexion with the protection of aquatic living resources and related environmental problems.

The expansion of FAO field activities, especially those deriving from the UN Special Fund, and the problems of planning and servicing field projects, as well as the recruitment of experienced scientists to conduct their research activities, was another matter which had been given prior attention by the Committee. Closer integration of the Regular Programme and field programmes is being attempted and, again on the basis of ACMRR guidance, more emphasis will be given to projects of research training at sea and at national laboratories.

In view of the budgetary difficulties which the Organization and, therefore, the Department are facing at present, Mr. Jackson emphasized the need to identify priority areas for action with respect to marine resources and environmental research. On the other hand, it was necessary to bear in mind the integration of scientific, economic and industrial development programmes.

Finally, Mr. Jackson thanked the Committee for its important contributions to FAO policy in the past and expressed his best wishes for a fruitful discussion during the present session.

1.2 Adoption of the Agenda

In introducing the Agenda (Appendix 1), the Chairman pointed out the probable need to establish some *ad hoc* discussions and drafting groups which would report back to the Committee during the Session. It was agreed to discuss Scientific Information System on Aquatic Sciences and Fisheries under Item 4.10, and Application of Ecological Theory to Exploitation and Conservation of Marine Fishery Resources, under Item 4.9.

1.3 Date and Place of Seventh Session

Arrangements for the Seventh Session of ACMRR were discussed in the light of likely dates and related international meetings and anticipated developments, from which it emerged that the most suitable time would be around the end of 1972 or the beginning of 1973. The possibility of needing a longer time for the next meeting should be borne in mind. The Committee agreed that final decisions as to dates and location should be left to the Chairman in consultation with the Secretariat.

1.4 Election of Officers for the Forthcoming Period of Activities

After thanking Dr. C.E. Lucas for his work during his period of office during 1965-71, the Committee elected Mr. Gunnar Saetersdal as Chairman for the forthcoming period of activities and Drs. D.L. Alverson and S.Z. Qasim as Vice Chairman. On the proposal of the newly elected Chairman, Dr. Lucas was appointed a member of the Steering Group along with the Chairman and Vice Chairman. At the conclusion of this item Dr. Lucas took the opportunity to thank all those who had served on the Committee during his period of office, and all members of the Secretariat for their help during a period of rapid change in which ACMRR had been enabled to play a significant role.

2. IMPLEMENTATION OF RECOMMENDATIONS OF THE FIFTH SESSION

2.1 General

The Secretary drew attention to the relevant parts of the Report of the Fifth Session of the Committee and presented a summary report on the activities of FAO Fishery Resources Division in the field of marine resources and environmental research and their application to management and development of world fisheries.

Although most of the recommendations that ACMRR had made during its Fifth Session were implemented, it had not been possible due to other urgent commitments and to staff and budgetary limitations, to take adequate action on the recommendations relating to scientific advice to fishery management and development bodies, nor to the follow-up of the FAO Conference on Fish Behaviour in relation to Fishing Techniques and Tactics. However, progress was recorded with regard to some of the underlying objectives of the first of these two recommendations, in the form of publication of several new compilations on the establishment, structure, functions and activities of international fisheries bodies, which had appeared in the FAO Fisheries Technical Paper series. Several other relevant documents were prepared by FAO staff after the Fifth Session of ACMRR and a comprehensive paper in 1970 by W.M. Chapman on "The Theory and Practice of International Fishery Development" was contributed to "Pacem in Maribus", held in Malta in 1970. The Secretary suggested that the Committee consider in its discussions on this matter the suggestions for action outlined in ACMRR:6/71/WP.7.

The Secretary also informed the Committee that, as a follow-up of the recommendation approved by the Fifth Session on the future Conference on Groups of Species (ACMRR:5/4.5.3), Drs. Kesteven and Ricker had prepared a rough draft of a document reviewing the subject and providing the basis for defining a policy on the matter. As the draft paper was not circulated prior to the meeting, and in order not to overload the already heavy agenda, the Committee recommended that members should address their comments to the Secretary, and that he should arrange for this, and other material requested by Drs. Kesteven and Ricker, to be sent to them with a view to preparing a position paper for consideration at the next session of the Advisory Committee.

The Committee expressed its thanks for the interest shown by Drs. Kesteven and Ricker in assisting with this matter. The Secretary also reported that the activities of the ACMRR/CARPAS Working Party on the Study of Fishery Resources in the Southwest Atlantic had been initiated by correspondence and that it had not yet been possible to convene a meeting of this Group owing to the difficulty in obtaining the data required for the study. He stated that CARPAS would hold its next session in March 1971, and that the Committee might wish to postpone any decision regarding the maintenance of this joint Group until its next session, at which time CARPAS' views on this matter could be considered in the light of developments.

The Committee approved the action taken by the Secretariat and noted with satisfaction the progress achieved by FAO in the inter-sessional period, despite various difficulties which had been anticipated.

3. POLICY ON SCIENTIFIC ASPECTS OF FISHERY RESOURCES MANAGEMENT AND DEVELOPMENT

3.1 Scientific advice to Fishery Management and Development Bodies

The Committee gave further consideration to the important question of the action which FAO might take regarding the provision of scientific advice to fishery management and development bodies. It reaffirmed that, with the rapid development of fishing pressure throughout the world's fisheries and the consequent growing need for the application of rational management measures, there is a pressing need for a detailed formulation of these requirements along the lines set out in the Report of the Fifth Session (Items 3.1 and 3.2, pages 4-12 of the Report). It noted that although the group of experts, the establishment of which was recommended at the Fifth Session to undertake preparatory work on this problem had not been appointed, nevertheless substantial progress had been made in the interim in clarifying the main issues. Important amongst these is the need for creating, especially in developing countries engaged in fishing, cadres of scientists familiar with the scientific principles, data requirements and methodology involved in the measurement and assessment of fishery resources, and appropriate systems which might be utilized for providing objective scientific advice on the state of the exploited stocks, the effects of fishing on them and the need for and effects of regulatory measures. The Committee therefore recommended that the Working Party envisaged at the Fifth Session be established, having terms of reference as set out in the above sections of the Report of the Fifth Session, with special reference to the following main tasks:

(a) identifying the kinds of scientific data and advice required by fishery management bodies at different stages in the development of fishing operations.

(b) defining the action and estimating the funds necessary to promote the collection of data and conduct the research necessary to provide this advice.

(c) establishing the procedures required to ensure the efficient supply and timely application of this advice in an objective and usable form, keeping in mind the need for:

  (i) identifying major problems of fisheries management

  (ii) examining existing methods, models and forecasting techniques used in fisheries management, so as to identify the deficiencies in these, and proposing extensions as well as new techniques and methods which will be responsive to contemporary and future changes in technology

  (iii) evaluating the impact on growth and management of fisheries of possibly changing management regimes which may result from the 1973 Conference on the Law of the Sea.

The Committee also stressed that, as far as possible, the Working Party should pursue these tasks in the light of the likely future trends in fisheries in different regions and the regimes applying to them.

The Committee recommended that Dr. C.E. Lucas (U.K.) be invited to serve as Convener for this Working Party.

3.2 Prerequisites for the application of a System Analysis Approach to Research and Management of Aquatic Resources

The Committee recognized that the methodology of system analysis is applicable to a wide variety of fishery problems at various levels of research and decision making. It is a relatively new discipline; few fisheries workers have formal experience in it and there appear to be no examples of completely documented system studies in the fishery literature. The Committee noted with satisfaction, however, that FAO is now training UNDP/SF project managers and Headquarters staff in network analysis, which is a technique used in system analysis.

Specific approaches of the methodology were reviewed. Certain important aspects of system analysis were stressed, particularly the emphasis on formulation of questions, and the need for the components in the decision-making procedure (e.g. objectives, assumptions, criteria, models) to be made explicit.

The method is well-suited for use by multi-disciplinary groups attacking problems of research, development, conservation and management of fisheries resources. Many of the problems of managing these resources and the environment are now so complex that they can only be effectively resolved by a group of experts working within a clearly defined systematic approach.

Examples of such complex problems to which FAO is expected to react appropriately include: development of criteria for national and international temporal and spatial allocation of stocks; needfor identification and development of effective management techniques for mobile, multiple-species, fisheries fleets; the increasing need to involve more scientists, institutions, and the several competing industries in practical decision making; the importance of understanding the effects of a fishery upon the living resource as an ecosystem and how the modified ecosystem then affects the fishery; and the need for data systems to be provided which utilize the full extent of contemporary information-processing technology.

In order to encourage developments of this methodology, and to assist FAO in their use of these methods, but also in order to work toward extending system analysis in the area of aquatic resources and multiple use of the oceans in general, the Committee recommended that:

(a) A roster of experts in this field be established which would be maintained in the Research Information Section of FAO Fishery Resources Division.

(b) A Working Party be established to plan for a seminar of experts to formulate a concise review of the present status and the potential application of systems analysis to fisheries problems. The technique of formal systems analysis should be tested by this group in a practical problem now facing the Department of Fisheries.

The Committee recommended that Prof. B. Rothschild (USA) be invited to act as Convener for this Working Party.

3.3 Remote Sensors - Possible application to Fishery Resources and Environmental Research

The Committee noted with interest the document "Application of Airborne Remote Sensing to Fishery Research and Development and to Fishery Operations" by Stevenson and Johnson, and the supplementary information made available by the Secretariat during the meeting. It considered remote sensing - in spite of present restrictions set by methodology and cost - as a potentially useful additional tool for research and for fishing operations, particularly in oceanic pelagic fisheries, which could provide fisheries research with wide range synoptic pictures of sea-surface parameters on a real-time basis, and assist the monitoring of some aspects of marine pollution.

The Committee in particular considered that aircraft remote sensing, limited at present mainly to coastal zones, has reached an operational stage, and assumed that satisfactory satellite sensing will become available in the near future. It therefore urged the Department of Fisheries to follow these developments closely. The Committee considered that meanwhile correlation studies between data obtained on marine parameters by means of airborne sensors, and the behaviour of fish and/or the location of fish schools, etc., should be intensified by countries having the adequate facilities for such research. The Committee felt that at this stage, however, the Department of Fisheries should not plan to get deeply involved in operational aspects related to the application of space technology, but should rather collaborate with IOC, WMO, and other Agencies concerned, particularly in connexion with IGOSS and WWW.

The Committee recommended that FAO publish the document prepared by Stevenson and Johnson in an appropriate way, after revision in accordance with the comments made in Appendix 5.

4. FAO PROGRAMME OF WORK IN THE FIELD OF MARINE RESOURCES AND ENVIRONMENT

4.1 Programme of Work for 1972/73 and Medium-Term Programme

In reviewing this important subject in the light of other items in the agenda, and especially in the light of the rapidly changing international situation, the Committee were necessarily reminded of previous reviews and particularly that occurring during the Fifth Session. On that occasion three points of major importance were made:

(a) It was anticipated that serious fishery changes might take place during the next few years, so that a sense of urgency was already being felt.

(b) The Committee was concerned with an increasing imbalance between the funding of the Regular Programme and that of the steadily increasing field programmes.

(c) For all that, it was impressed with the recent trends in Departmental activities.

Taking the last point first, the Committee felt bound to point out that the new framework within which the programme is cast (classification adopted for Programme and Sub-Programme items) has made it much more difficult, rather than easier, to identify the proposed distribution of effort over the field as a whole. While the Committee was impressed with the work achieved by the devoted efforts of the very limited regular staff, it was especially difficult to make comparisons with previous programmes, and then to identify trends and to comment on them. In particular, more regional references would be useful, with manpower identification. It was, however, immediately apparent that, not only would it be necessary to repeat the cautions and recommendations urged in 1968, but such is the rate of change in the international field that it is necessary to emphasize them. Allowing for inflation of various kinds it seems doubtful whether the regular/field ratio is being maintained, much less improved, and there seems no prospect whatever that the regular staff will be sufficient to help initiate and support properly the increasing number of field programmes alone, much less anticipate and cope with a rapidly changing situation.

In reaching these conclusions the Committee were very conscious of the confirmation in some measure during 1969 of their fears that the catches, of conventional species at least, would not continue to increase as rapidly as they had done for many years. The Fishery Resources Division must be staffed to deal with the various aspects of such a change, from assisting with assessing the prospects of unconventional stocks and re-assessment of the conventional ones, perhaps under modified fishery regimes, to providing advice on investment and accompanying risks at a time when risk capital is less easily come by than it was a few years ago.

With the institution of country programming for UNDP, there is a greater need than ever before for FAO to be in a position to take an overall view of the status of resources on both a regional and a global basis, and thus provide a general framework within which national development plans may be appraised.

The Committee noted with satisfaction that IOC under its new statutes, with its broadened secretariat, and with inter-agency support coordinated through ICSPRO, is on the way to becoming an inter-governmental instrument through which a number of organizations in the UN system, including FAO, can most economically and efficiently seek to discharge some of their responsibilities for marine environmental and related investigations. In the view of the Committee FAO should take full advantage of this development in the coming years, including the possibility of thus supplementing the work of the regional fishery bodies in the environmental field.

The Director-General of FAO has played, in the past, an active, even a leading role in encouraging this evolution of the IOC, and the Organization should continue its cooperation to ensure the fullest benefit to fishery science, development and management, and to ensure the participation of national fishery research agencies in the process of marine science policy formation through the Commission.

The Committee were pleased to note that it was proposed to continue the contribution that FAO, as one of the ICSPRO organizations having the greatest interest in promotion of marine research, and its application to fisheries, had been making to the work of the IOC. They noted, however, that effective coordination and development of the Long-Term and Expanded Programme of Oceanic Exploration and Research, in many cooperative exercises in which FAO is directly involved or from which FAO programmes will benefit, will require continuing and adequate financial and staff support by the Organization.

There have been other changes, however, important among which have been the developments taking place within the Expanded Sea Bed Committee of the UN, whereby not only is a second Law of the Sea Conference in the offing (with all its implications for fishery commissions and regimes), but even while ACMRR was meeting decisions had been reached on arrangements to draft articles of an International Treaty dealing with Marine Pollution and with research. Some of the implications for and responsibilities of FAO and the

Department of Fisheries as regards the former are obvious enough, while others will emerge, perhaps at short notice. No less far-reaching would be the import of a pollution treaty, especially in view of the initiative already taken by FAO (and ACMRR) in this field, in its recent Technical Conference (and Seminar), together with its involvement in GESAMP and, via ICSPRO, ACMRR and the other advisory bodies of IOC, in GELTSPAP and LEPOR now under consideration by IOC. The latter includes a major component directed to a Global Investigation of Pollution in the Marine Environment, for which intensive training, research and surveillance are required, which seem equally necessary whether some of the dangers envisaged are genuine or can be shown to be false alarms.

The Fishery Resources Division is also called upon particularly to contribute to implementation of other important decisions of the UN concerning ocean affairs, in particular the preparations for the 1972 Conference on the Human Environment (which will deal extensively with marine pollution and environmental monitoring) and ECOSOC Resolution 1547 on trends in ocean use and interactions between these.

In the light of these developments the Committee is convinced that the Regular Programme sector of Fishery Resources Division is not only understaffed at the moment, and as understaffed relatively as it was two years ago, but that the situation will worsen very rapidly. While the Committee was aware of the financial content of the present exercise of FAO Programme and Budget preparation, it felt that some minimum and immediate measures are essential to avoid the worst consequences of this situation and accordingly urges:

(a) Strengthening the capability of the Data Centre through support of UNDP, as a service for field projects and assistance to member countries, particularly developing ones.

(b) Speedy strengthening of the staff for stock assessment by bringing forward to 1972 the proposal to appoint in 1973 a new senior professional, in order to meet needs arising from the decisions to convene a new Conference on the Law of the Sea, the inclusion of marine resource management as well as marine pollution in the agenda of the UN Conference on the Human Environment, and associated requirements of regional fishery bodies.

(c) Establishing a post early in the next biennum on marine pollution.

(d) Adequate operational funds to initiate and promote these high priority activities.

The Committee further recommended that all possible steps be taken to ensure that the numbers in staff thereafter be brought up to the level originally envisaged for the Department, with subsequent growth proportionate to the increased demands already foreseen and specified in other sections of this report. This need applies no less, in the Committee's opinion, for the adequate servicing of ACMRR itself, during and between sessions, than for the obviously vital matters set out above.

4.2 Survey and Charting of Fishery Resources

The Committee noted with satisfaction that, as a result of the work undertaken by the ACMRR Working Party on Survey and Charting of Fishery Resources, the draft for a "Manual of Methods for Fisheries Resource Surveys" had been completed and submitted to FAO Department of Fisheries.

The Committee was informed that the provisional version of the Manual will be printed this year by the FAO/UNDP Polish High Seas Fisheries Project, and will be used as a background textbook for the Training Course on Resource Survey Techniques meeting to be held in Gdynia, Poland, during the spring of 1972. Following modifications to the report, based on its use during the Training Course, and on comments from ACMRR members and other selected experts, the document will be published in the FAO Fisheries Manual series.

It is expected that the Manual will find its greatest use in the developing countries and by FAO field survey personnel involved in resource assessment activities. The Committee strongly urged that project managers of FAO field projects take note of the section in the Manual dealing with data collection and field sampling and promote its application.

The Committee considered that the development of effective systems to collect and record data and other information collected by FAO/UNDP on fishery surveys, and for data storage and processing systems, is a matter of high priority. It considered that the FAO Fishery Data Centre could provide an appropriate mechanism to assist with this, but could meet this need only on condition that it be strengthened in its operational capacity and staff (see item 4.1) and that field project managers, given appropriate terms of reference as regards data collection, documentation and storage, be encouraged to cooperate.

The Committee further noted that the Fishery Data Centre is preparing a Handbook which will set out data collection methods and reporting standards for FAO/UNDP resource surveys. The production of this Handbook together with the Manual and other activities of the Fishery Data Centre in this context should be brought to the attention of UNDP.

The Committee noted that the Manual stressed that the results from field surveys increased exponentially when designed and executed in a scientific manner. The problem of standardized sampling systems, to facilitate comparison of data collected from different geographic areas and times, was discussed and the Committee recommended that FAO examine carefully its field assessment programmes with the object of standardizing methods, although it recognized that in some instances changes in fish behaviour and/or environmental conditions would require modification of sampling procedures. It was also noted that fishing experiments designed to improve harvesting gears (although in themselves valuable), and simulated commercial fishing experiments, are of very limited value for resource assessment activities; such operations by their nature are discontinuous and hence provide little or no comparability between the results.

The point was made during the discussion that fishing charts reflecting time series, density and distribution features of the species surveyed, where appropriate environmental features can be incorporated, can provide a valuable means of presenting and disseminating information. In some instances, Cooperative Investigations organized jointly under IOC (e.g. CICAR, CSK, etc.) could contribute valuable data resulting from their biological studies, and advantage should be taken of these opportunities. Similar charts, for areas where fisheries have been intensely exploited, would also provide a basis for decision when faced with competing demands arising from alternative or multiple uses. Such information would be of considerable value to developing countries, and its production should be encouraged, and supported with the assistance of UNDP and bilateral aid funds. It was recognized, however, that the preparation of such charts would require the assistance of the Fishery Resources and Fishery Industries Divisions.

Recognizing that the Working Party had fulfilled its task, the Committee expressed its appreciation for the work done and decided to disband the group.

4.3 Fish Egg and Larval Surveys

The Committee reviewed the report of the Working Party on Fish Egg and Larval Surveys and endorsed the suggestion that a Manual on the techniques of these surveys should be written by members of the Working Party. They emphasized, however, that egg and larval surveys are only one of a series of possible techniques for stock assessment and further suggested that it would add to the value of the Manual if it also provided a review of the circumstances under which egg and larval surveys are more appropriate, or cost-effective, than (for instance) hydro-acoustic, airborne remote-sensor or exploratory fishing surveys. The Committee also suggested that a cautionary review of the pitfalls inherent in the egg and larval survey technique should be included in the Manual, as well as a review of the ancillary studies of (for instance) temperature-dependent development rates of stages of eggs and larvae, of fecundity, and of reproductive cycles of target species which are a sine qua non of egg and larva surveys; the Committee felt that it was essential in an FAO-sponsored manual on this subject that potential new users of this survey technique should be given a fully balanced view of its values and limitations, with an indication of the extent of ancillary studies to which a potential user must be prepared to commit himself.

The ACMRR Working Party on Fish Egg and Larval Surveys had proposed that a Symposium be held on the Biology and Systematics of the Early Life Histories of Fishes, and this suggestion was adopted by IABO at its meeting in September 1970. The Committee recommended that, in the event of this Symposium being held, it should place particular emphasis on taxonomic techniques and related subjects, as the proper identification of biological material is one of the major factors hampering the effectiveness of egg and larval surveys, especially in tropical seas.

The Committee endorsed the Working Party's statement of the need for training courses in techniques for the study of the early stages of fish, and recommended that FAO arrange for support of those training courses either through Technical Assistance funds or through member states; the publication of the Manual might be similarly supported.

The Committee was then stimulated to discuss studies in larval fish biology in relation to the stock/recruitment problem and to year/class variation. It felt that, because the recent Stock/Recruitment Symposium at Aarhus had given relatively slight attention to larval studies, FAO might care to consider initiating a second symposium, directed primarily at larval studies relevant to these problems, and to explore this idea with ICES and others concerned.

After expressing their appreciation of its work, the Committee decided that this Working Party should now be disbanded, but requested its members to complete their task of preparing the manual by correspondence with Professor Hempel - who will act as editor - and with the Secretariat.

4.4 Use of Submersibles and Underwater Habitats in Fishery Research

The ACMRR Working Party on the Use of Submersibles and Underwater Habitats in Fisheries and related Marine Biological Research, which was recommended by the Fifth Session, was established during the inter-sessional period to make an appraisal of the use of this type of facility in fisheries and related marine biological research, and a progress report was presented by the Convener, Mr. B.B. Parrish. The Committee noted that a detailed report, covering the group's activities, is nearing completion and recommended that FAO make the necessary arrangements for it to be published at an early date. It stressed the importance of including in the report reference to the cost element in assessing the potentialities of using this type of research equipment in comparison with other methods. The Committee suggested that the report of the Working Group be made available to the Gear and Behaviour Committee of the ICES, in view of its interest in the in situ observations on fish behaviour studies in connexion with gear development activities.

It further noted that the organization of a seminar to evaluate the application of underwater facilities to marine science and its application at various geographic locations may be opportune. The Committee was informed that a Marine Biological Symposium, to be held at the Biological Station, Heligoland, in 1972, will be concerned with "man in the sea" techniques and their use in marine research, and that this could provide a suitable forum for further consideration of these problems. It accordingly recommended that the Secretary, in consultation with the Convener, explore, with the organizers of the Symposium, the possibility of inclusion in the programme of the subjects mentioned above, and suggested that FAO offer its collaboration in the preparation of the relevant items of the programme for and organization of the Symposium, through the ACMRR Working Party.

The Committee's attention was drawn to the need for a review of the current use and potentialities of alternative techniques and equipment, particularly optical and acoustic ones in combination, in fisheries and marine biological research and especially in relation to resources surveys and abundance estimation. It noted that much relevant information is already available in publications, and accordingly recommended that FAO take the necessary steps to undertake such a review, in collaboration with experts in this field.

The Committee therefore decided to maintain the Working Group in existence until the Symposium has taken place.

4.5 Use of Acoustic Methods for Evaluation of Fishery Resources: Future requirements for the facilitation of research and exchange of information in this field (Progress Report by special correspondents)

(a) The Committee recalled that at its Fifth Session it decided to disband the Working Party on Direct and Speedier Estimation of Fish Abundance since it had completed its task of preparing a Manual. At that time the Committee invited two of its members (Mr. B.B. Parrish and Mr. L.M. Midttun) to continue to act as correspondents on developments in this field. A report was presented by Mr. Parrish to the Committee.

A first draft of the FAO Acoustic Manual was used at a training centre held at Svolvaer, Norway from 2 to 5 March 1969, jointly organized by ICES and FAO. A report on this course, entitled "Technical Report of the ICES/FAO Acoustics Training Course" was published by FAO. This successful first course will be followed by a second being organized by FAO in conjunction with the Norwegian International Development Agency (NORAD) in Latin America in September 1971.

The use of acoustic methods for fish detection and abundance estimation has been playing an increasingly important part in the UNDP(SF)/FAO fisheries surveys. The Manual has proved of exceptional value for training of experts from developing countries. It is now being updated and the final version will be published in the FAO series "Manuals on Fishery Science".

A report was given of recent advances in techniques but it was pointed out by the correspondents that they find it increasingly difficult to keep close contact with developments in this field. The Committee therefore suggested that a "Panel of Experts on the Facilitation of Acoustics Research in Fisheries" be set up, and that the membership be drawn from the institutions engaged in research in this sphere and that FAO provide the technical secretariat, in order to ensure the necessary mechanism for continuing joint appraisal of progress and close coordination of research.

The Committee recommended that the terms of reference of the Panel should be as follows:

(i) To keep under review the work in progress on the development of specialized acoustic fish detection equipment and operational techniques and their application in fish abundance estimation studies.

(ii) To facilitate and coordinate the national research effort by identifying the limitations of the existing techniques and principal lines of future work.

The Committee designated Mr. B.B. Parrish as the Convener of the Panel and suggested that FAO, with the assistance of the Convener, consult the national research institutions concerning the composition of the Panel.

The Committee envisaged that initially the Panel could conduct its business by correspondence but that meetings would be necessary from time to time.

The Committee suggested that the review prepared under item 4.4 on current use and potentialities of alternative techniques and equipment particularly optic and acoustic ones in combination, be brought to the attention of the Expert Panel.

(b) The Committee noted further that the IOC Bureau and Consultative Council at the 12th meeting in Bordeaux "invited ACMRR to continue to keep under review the use of acoustic methods in studies of living resources and to initiate appropriate action to promote cooperation between research institutions active in this field, and to disseminate the results of studies", and suggested that the FAO Panel of Experts to be established should also fulfil this request.

(c) Noting the invitation extended to FAO by ICES for possible collaboration in organizing a Symposium on Acoustic Methods in Fisheries Research to be held in 1973, the Committee expressed its willingness to extend the requested assistance through the Expert Panel.

(d) The Committee considered the report of a meeting for Consultations on Underwater Noise held in Rome, 17 to 19 December 1968 under the Chairmanship of Mr. J.O. Traung. The Committee were informed that the report on these consultations, together with a compilation of a comprehensive bibliography on the subject, had already been prepared (FIRM/R/6). The Committee endorsed the recommendations of the meeting, and agreed that it would serve a useful purpose if FAO, in close collaboration with the Marine Research Institute, Bergen, Norway, could update and translate into English a thesis in Norwegian by Mr. Gjestland entitled "Generation of Underwater Noise by Vessels, its Character, and its Influence on Fishing and the Use of Sonar Equipment".

4.6 Duties and Functions of the FAO Fishery Data Centre

The Committee reviewed the proposals and plans for the further development of the FAO Fishery Data Centre. It stressed the importance of this development and considered that high priority should be placed on it as part of FAO's future programme, especially in relation to the supply of data for resource appraisal and stock assessment work. The Committee recognized that the scope and extent of the Data Centre's activities will be necessarily governed by the level of funding available and that, at least in its initial stages, priorities must be set on the types of data collection to be handled in the Data Centre. It considered that first priority should be given to the provision of a data storage, retrieval and analysis service for UNDP/SF or TA projects and stock assessment activities of FAO regional bodies, and other sources of data useful for the FAO World Appraisal of Fishery Resources (follow-up of PSWAD).

In response to the request from GESAMP, the Committee also suggested that FAO consider the possibility for the Centre to serve as a repository for relevant levels of pollutants (other than radio-active nucleids) in marine organisms, pending the identification of a permanent storage system for these data.

In view of their importance in stock assessment work, the Committee stressed the need for steps to be taken to ensure that appropriate catch and fishing effort data are collected and made available in a suitable form, when required, for stock assessment work, along with resource survey and biological sampling data from the Data Centre. It also stressed the importance of developing standardized procedures for the collection and recording of data to be stored in the Centre.

The Committee recognized that the effectiveness of a data storage and retrieval centre of the type envisaged is governed by a number of factors, including:

(a) Proper identification of the kinds of data required by their users.

(b) The quality and quantity of the data collected to meet these requirements.

(c) The efficiency of the data reporting, storage and retrieval system.

Accordingly, the Committee recommends that FAO seek the advice of experts (consultants) in the fields of data collection, data processing and stock assessment to assist in the further development of the Data Centre.

Also, in view of the Committee's opinion that the Data Centre's first priority should be given to providing storage, retrieval and analysis of stock assessment data to service UNDP/FAO projects and FAO regional bodies, the Committee recommends that FAO seek direct financial support for the operations of this phase of the Data Centre from UNDP and IBRD.

4.7 World Appraisal of Fishery Resources: Updating of the Fishery Sections of PSWAD and Follow-up Activities

The Committee expressed its great appreciation of the work of the Fishery Resources Division that has led to the issue of FAO Fisheries Technical Paper No. 97, "The Fish Resources of the Ocean". The volume is considered to be a comprehensive review of currently available information on the world's fish resources, and the plan to give it a wide distribution through private publication was endorsed. It was recommended that the volume should be accompanied by a foreword by the Fishery Resources Division, concerning the general status of the assessments at this stage and an outline of the plans for the follow-up work.

There was general agreement that high priority should be given by FAO to following-up this work through a continuing programme identified as the FAO World Appraisal of Fishery Resources. A number of problems connected with this programme were discussed.

When considering the types of data and their adequacy and the models employed in these assessments it was generally agreed that the best prospects for improvements at present lie in refining the inputs to the models. This is true both for total energetics models, which were not considered to permit immediate practical application in the present state of knowledge of trophodynamics, as well as for exploitation models, where attention in particular was drawn to the need for a more complete understanding of the relationship between catch and effort data and stock abundance, particularly in fisheries on pelagic schooling species.

In this context the value of estimates of stock size independent of fishery data was stressed. There is a need for a continued promotion on a world-wide basis of all the various methods of resource evaluation and the Committee recommended that FAO should continue to place great emphasis on its programme of training and education in this field.

The sources of data and the organization and procedures for updating the assessments were discussed. It was agreed that wherever possible FAO's and other regional bodies should be used, and that funds should be made available to the Fishery Resources Division to fulfil its responsibility in this field, through the system of consultants and national and regional contacts used in the original assessments which proved to be an effective experiment. Priority orders for updating the assessments should be set up on the basis of classes of resources, availability of data, and need for new estimates. It was proposed that the updating of the estimates should form a "fishery resource evaluation data bank" which will be kept current, and the information of which should be immediately available on request. The FAO Fisheries Data Centre will serve as a depository for all the assessments and re-assessments and the Committee wished to stress the importance of this service and the need for upgrading and expanding its functions so as to enable it to fulfil these tasks. Because of the direct importance of the FAO World Appraisal of Fishery Resources project, and related supporting services, to fishery management and development activities, and as a basis of information for investment activities, the Committee strongly recommended that assistance from UNDP, IBRD and other interested sources of funds involved in this area of work, should be sought so as to permit this project and the supporting services to attain the required level of efficiency.

The Committee furthermore endorsed the plan to issue new updated summaries of assessments on a regional basis when appropriate. A flexible system should be used if possible and priority should be given to regions with under-exploited resources and where fishery development is expected.

The Committee also recommended that FAO should review the problems of obtaining better estimates of the potentials of unconventional resources so far omitted from the current world summary of fish resources.

Following a more general consideration of the assessments contained in "The Fish Resources of the Ocean" the Committee wishes to draw attention to the following main points:

(a) That the total world potential for conventional fish products allows for a considerable increase in yield particularly if the large potential for unconventional species (squid, small fishes, krill, etc.) can be used.

(b) That many of the present high value ocean's living resources are being fully utilized, or soon will be fully utilized, and that their rational management is essential to maintain catches from these resources near their potential.

(c) That the growth of great mobile and world-ranging fishing fleets makes urgent the need for rapid evaluation of the state of resources and management advice.

In view of the importance of these problems, the Committee decided to maintain the World Appraisal of Fishery Resources as a permanent item in the agenda for its sessions, and to express its willingness to assist in all possible ways in the execution of this activity, including through ad hoc groups of experts as required, keeping in mind the need to evaluate the impact on growth and management of fisheries of possibly changing management régimes which may result from the UN Conference on the Law of the Sea.

4.8 Improvement of Marine Resources and Mariculture, including Transplantation of Marine Organisms

The production of fish, shellfish and commercially important algae, by aquaculture, is being increasingly recognized in most countries of the world. The present estimated total production by aquaculture of about 4 million tons, is used almost entirely for human consumption. According to the Provisional Indicative World Plan for Agricultural Development - A Synthesis and Analysis of Factors Relevant to World Regional and National Agricultural Development (FAO Conference Document 69/4, August 1969, Vols. 1 and 2, 672 p.) - the present production is capable of a five-fold increase by 1985 and the main constraint to such an increase is thought to be the low level of aquacultural inputs. More optimistic rates of increase, as much as 20 times or more, have been predicted in other studies.

The Committee considered the two review papers "Introduction of exotic marine, eurihaline and anadromous organisms", a preliminary review by L.A. Walford and R. Wicklund, and "Acclimatization of aquatic organisms in the USSR" by A.R. Karpevich, prepared in response to a Recommendation of the ACMRR Fifth Session (ACMRR 5.2.4) in implementation of a request from SCOR, and expressed its appreciation for their valuable contribution. In view of the importance of the subject and the scarcity of consolidated studies in this field, the Committee recommended that FAO should issue the revised versions of these reports in one of its series in order to give them a wide distribution, and bring them to the attention of the ICES Committee on Fisheries Improvement.

An interesting discussion ensued on the present status of transplantation of marine organisms for the development of commercial stocks. The Committee agreed that further study of inter-specific relationships of marine communities would serve as a useful basis for determining the suitability and possible scope for large-scale transplantations.

In view of the steadily increasing importance of aquaculture in both the developing and developed countries, the Committee discussed the suggestion to hold a Technical Conference on Aquaculture in 1974 or 1975. It was felt that such a meeting could critically review the progress in research and development in this field and formulate plans for future action. It therefore recommended to the Director-General of FAO that inclusion of such a conference in the Programme of Work of the Organization should be considered.

In view of the various proposed activities to be undertaken in the field of aquaculture, by FAO and other international organizations, the Committee recommended the establishment of a Working Party, in cooperation with IABO and other appropriate bodies and, in view of the diversity and vastness of the problems involved, recommended that it should focus its attention on aquaculture and consider transplantations and introductions only insofar as they relate to aquaculture. It was decided that the terms of reference of the Working Party should be:

(a) To review the recommendations of recent meetings pertinent to aquaculture, particularly those of the IOC/GELTSPAP (November 1970) meeting and the FAO Technical Conference on Marine Pollution and its Effects on Living Resources and Fishing (December 1970), and assist FAO and the other organizations concerned in designing regional and international research programmes on aquaculture in the estuarine and marine environments, and their application to national development programmes.

(b) To provide, together with other groups concerned with these problems, guidance to FAO in the preparations for the proposed FAO Technical Conference on Aquaculture.

The Committee recommended that Dr. C. Idyll (USA) be invited to serve as Convenor for this Working Party.

4.9 Follow-up of the FAO Technical Conference on Marine Pollution and its Effects on Living Resources and Fishing (1970), and of the Seminar on Methods of Detection, Measurement and Monitoring of Pollutants in the Marine Environment; Preparation for the UN Conference on Human Environment (1972); Application of Ecological Theory to Exploitation and Conservation of Marine Fishery Resources

4.9.1 The Committee noted the important role of FAO in the field of marine pollution and endorsed the action taken since its last session, including preparations for the UN Conference on the Human Environment (1972). It noted with satisfaction that close coordination with the other agencies concerned has continued and expanded, and stressed that FAO has a special responsibility for ensuring that work related to the protection of the living resources and to fisheries aspects is undertaken as one major part of the activities now being planned in the field of marine pollution.

4.9.2 The Committee emphasized that surveillance systems proposed for the marine environment should be designed and operated bearing in mind the need to protect living marine resources. It therefore recommended that FAO be closely associated with activities and bodies engaged in the planning of such systems, in accordance with the guidelines set out in the recommendations of the FAO Conference on Marine Pollution and its Effects on Living Resources and Fishing, and of the Seminar on Methods of Detection, Measurement, and Monitoring of Pollutants in the Marine Environment.

4.9.3 The Committee recognized the urgent need of developing countries for trained specialized personnel in the field of marine pollution research, and for technical assistance in environmental studies and management. It noted with great interest the FAO Marine Pollution Conference recommendation that UNDP and other international sources of funding should provide assistance to projects in this area of work, and recommends that FAO should actively explore these possibilities. It further recommended that FAO consider, with the help of bilateral aid, carrying out marine pollution programmes and holding regional seminars in order that the developing countries might obtain a balanced and realistic view of the marine pollution problem in relation to living marine resources and formulate their requirements in this field.

4.9.4 The Committee agreed that the IOC should be used as a common instrument for the co-ordination of the implementation of operational programmes in this field. It studied the section of the Report of the GELTSPAP dealing with marine pollution and the comments made by the Third Session of GESAMP.

It endorsed the proposal that the Global Investigation of Pollution in the Marine Environment (GIPME) should be established as a major project in the LEPOR, and noted that the Twelth Session of the IOC Bureau and Consultative Council had requested the scientific advisory bodies of IOC, together with GESAMP, to cooperate in developing the elements of the programme of investigation and to prepare proposals on the organization of the work for consideration at the Seventh Session of IOC. The Committee recommended that a Working Group should be established in order to prepare these proposals. This Group should be nominated by the officers of the scientific advisory bodies to the Commission, and GESAMP, and consist of one officer and two nominees of each body, together with representatives of the ICSPRO organizations (UN, FAO, Unesco, WMO, IMCO) and the Secretary of IOC. The Group should meet for about five days in the early summer of 1971 and have the following terms of reference:

(a) To review relevant documents concerning programmes of scientific investigation of pollution in the marine environment.

(b) To identify the lines of research that appear to be the most effective in such investigations.

(c) To develop an outline for GIPME, including estimates of priorities and timing, and of the facilities and manpower required, and to suggest institutional arrangements for the planning and coordination of the work and the allocation of responsibility for parts of the programme among the various interested organizations.

(d) To follow the regional approach to the development of GIPME suggested by GESAMP and to (i) consider areas, additional to those named by GESAMP, in which investigations might be commenced at an early date, and (ii) bear in mind the need to enable the developing nations to take an active part in GIPME.

4.9.5 The Committee noted the comments made by COFI at their Fifth Session, that the work of the Department of Fisheries is liable to be hampered by the lack of staff specialized in aquatic pollution, and that consideration should be given to strengthening the Fishery Resources Division in this sector. The Committee endorsed this view, and recommended that FAO allocate adequate funds to allow the Department of Fisheries to play the role member countries expect in this field, especially as a catalyzer and coordinator for the above-mentioned activities.

4.9.6 The Committee noted that several recommendations of the 1970 Conference on Marine Pollution urged FAO to extend its efforts in encouraging research, as well as in identifying and applying ecological theory and information, particularly toward pollution problems at the level of aquatic ecosystems (see Marine Pollution Conference recommendations 1.8, 5, and 7.5). In the past this Committee has recommended that FAO cooperate in sponsoring other conferences and symposia on ecological matters related to exploitation, e.g. the 1968 Conference on Marine Food Chains.

It was noted that the Fishery Resources Division had begun investigating the application of models that were derived from trophodynamic studies, others that relate to properties of a community using stability and diversity indices, and still others that stem from classical limnological work. These will serve to complement the usual population dynamics approach to problems of fisheries exploitation (which in itself is being extended to multiple species contexts) and the dominantly physiological approach in pollution studies. In addition, there are more sophisticated models concerning, for example, the dynamics of inter-acting systems and others that utilize graph theoretical methods, which have as yet made virtually no impact on FAO's approach to its practical programmes.

As a step toward identifying useful advice and applying it in FAO contexts, the Committee recommended that a Working Party on Application of Ecological Theory to Exploitation and Conservation of Marine Fisheries Resources be established, including members from ACMRR, INTECOL and IABO and other appropriate bodies, to produce a brief, semi-technical review of available broad ecological models and information applicable to the problem areas in conservation and management of fisheries resources, both with respect to exploitation and pollution. This report should provide FAO decision-makers with a broad view of the field, the technically practical man with a guide to useful advice, and the theoretical ecologist with a stimulus to apply his insights to practical ends.

The Committee decided to invite Dr. H. Regier (Canada) to act as Convenor for this Working Party.

4.10 Scientific Information System on Aquatic Sciences and Fisheries

The Secretariat reported on those elements of a comprehensive Scientific Information System which are presently contemplated by the Fishery Resources Division, and which involve the close cooperation of several national institutions and a number of international organizations.

A computer-oriented system, which has retrospective search capabilities, is expected to be operational during early 1973. This system, based mainly on the bibliographic data input, will also be capable of providing information on aquatic scientists and research facilities, and on institutions and their activities in the field of fishery resources research and marine research generally, and will constitute an important part of the input for the preparation of expert and institutional directories, mailing lists, and other similar services which may be required by the scientific community.

The Committee commended the collaboration between FAO, Unesco, and SCOR in the preparation of the International Directory of Marine Scientists, and recommended that it be maintained effectively and up-dated periodically, with the advice of an Ad Hoc group of nominees from ACMRR, SCOR, FAO, and Unesco.

The Committee affirmed that there is an urgent need for an efficient information system which would not duplicate existing services in this field. It further recognized that the efficient operation of research information services is dependent upon accurate assessment of the users' requirements for such services.

The system would need to incorporate the elements already being operated by FAO Fishery Resources Division and which, with assistance from Unesco, are progressively being expanded in subject scope to cover all interests of marine scientists, as well as fishery research in the narrow sense. In addition, however, the work of the IOC Group of Experts on Long-Term Scientific Policy and Planning had shown clearly the need for exchange and compilation of information about current and planned marine research projects: national, regional, and international. The Committee noted the recommendation of the Twelth Meeting of the IOC Bureau with the Consultative Council that the IOC Secretary should arrange for the preparation of a detailed proposal, for consideration by the Seventh Session of the IOC (October-November 1971), for establishing an international information service.

The Committee recommended:

(a) That an Ad Hoc Editorial Board be established with nominees from ACMRR, SCOR, FAO, and Unesco to provide further advice on the nature and kind of services required by the scientific community and suggest means for carrying them out.

(b) That the Ad Hoc Editorial Board also monitor the core list of journals, the contents pages of which are reproduced in the "Marine Science Contents Tables".

(c) That the Fishery Resources Division cooperate fully with the IOC Secretariat in preparing the detailed proposal to be considered by the IOC Seventh Session.

(d) That FAO contact directly those responsible for developing UNISIST and offer cooperation in the field of marine science.

5. MATTERS CONCERNING THE INTER-GOVERNMENTAL OCEANOGRAPHIC COMMISSION (IOC)

5.1 Planning and Implementation of the Long-Term Expanded Programme of Oceanic Research (LEPOR)

In considering the development of the Long-Term and Expanded Programme of Oceanic Exploration and Research (LEPOR) of IOC, the Committee paid particular attention to Rec. 12.4 of the 12th Meeting of the Commission's Bureau and Consultative Council, which inter alia called for the GELTSPAP report to be submitted to ACMRR (and the other scientific bodies) for examination and possible comment prior to the Seventh Session of the Commission. It was agreed that ACMRR members, in further studying the report, should consider whether important kinds of investigations had been omitted, and whether the investigations proposed were of high scientific quality and relevance to the goals of LEPOR, and that they should suggest which exercises needed highest priority. Their comments were to be sent to Dr. C.E. Lucas for compilation prior to 15 April. After consultation with the Chairman and Secretary, these views could then be discussed at the SCOR Executive Meeting in May 1971, with the hope that a consolidated comment from these two advisory bodies could be sent to the IOC prior to its Seventh Session.

Recommendation 12.4 of the IOC Bureau and Consultative Council requested the scientific advisory bodies to examine certain proposals and, where desirable and feasible in their view, to take appropriate steps.

The following proposals were directed specifically to ACMRR:

(a) Acoustic observations - ACMRR was asked to continue to keep under review the use of acoustic methods in assessing stocks of living resources, to promote cooperation among research institutions and to disseminate the results of studies. As noted under item 4.5, the proposed Panel of Experts will make it possible for ACMRR to meet this request.

(b) Cephalopods and deep-sea living resources - ACMRR was invited to consider ways of promoting research on cephalopod stocks and living resources of the deep sea. The Committee recommended that the Secretariat arrange for preparation of review papers on these topics, selecting the authors from countries whose scientists have had the greatest experience in the study and exploitation of such resources. It was also agreed to bring the GELTSPAP proposal to the attention of ICES and its Shellfish-Benthos Committee.

Other proposals which were directed to all of the scientific advisory bodies include:

(a) Coastal upwelling - The scientific advisory bodies were invited to enquire into strategies for studying coastal upwelling. This question is closely related to another proposal, for a comprehensive study of the ecosystem of an upwelling region off north-west Africa (CINECA). The Committee recommended that SCOR take the lead in organizing a workshop on the design of investigations of coastal upwelling, and that ACMRR and ACOMR should participate in organization and support of this workshop. If practicable, this study should be focussed on CINECA. ICES and other appropriate organizations should be invited to participate.

(b) Coastal aquaculture - ACMRR was invited to develop a plan for an international exercise concerned with the improvement of resources in coastal and related areas. Establishment of an ACMRR-IABO Working Party on Agriculture (see item 4.9) is relevant to this request.

The scientific advisory bodies were also requested to examine certain other proposals with a view to preparing more detailed plans for consideration by the Commission.

The scientific advisory bodies were also requested to examine certain other proposals with a view to preparing more detailed plans for consideration by the Commission.

Those pertaining to ACMRR were:

(a) Living resources of the Antarctic - It is understood that IOC are considering inviting Member States to set up a resource survey planning group to work jointly with physical oceanographic groups in planning an integrated living resource survey in the Antarctic. The Committee noted the existence of an IOC International Coordination Group for the Southern Ocean and expressed the hope that marine biologists and fishery scientists would be adequately represented in delegations to meetings of that group. Although that group appeared to be the appropriate body under which to organize a living resources survey, the Committee felt that a discussion of present knowledge of the ecology of the region would be a useful contribution to preparations for the survey, as well as bearing on the important question of the effects of marine pollution in polar ecosystems. The plans of SCOR and SCAR to hold a symposium of polar oceanography in 1972 were noted, and the Advisory Committee offered to discuss participation in the organization and support of that symposium during the forthcoming SCOR Executive Meeting.

(b) Polar ice research - Development of a polar ice research project under LEPOR, including research on ecology and living resources of the Arctic, is proposed. This question is related scientifically to that of the Antarctic, and the Committee suggested that the 1972 Symposium might be planned so as to deal with both regions, although some of the difficulties of doing so, from a biological point of view, were appreciated by the Committee. From an operational point of view, other organizations are involved than those concerned with the Antarctic. ICES has a major role, and the Committee agreed to discuss with ICES and the other scientific advisory bodies the possibility of setting up an ad hoc group to examine possible marine research programmes in the Antarctic.

5.2 Planning of the Integrated Global Ocean Station System (IGOSS) and Monitoring of the Marine Environment - Specific Requirements for Fishery Applications

IGOSS is a system approved by IOC and WMO for monitoring and prediction of ocean conditions. The World Weather Watch (WWW), on the other hand, was developed by WMO for the monitoring and prediction of atmospheric conditions. Because of the inter-actions between ocean and atmosphere over much of the earth's surface, and the particular problems of data collection from the oceans, the systems are closely related and will undoubtedly have many common elements but, with the difference in properties of the fluids concerned and in the execution of the two programmes, it is inevitable that each will have unique features.

The Committee, having considered the various aspects and characteristics of IGOSS, was of the opinion that the system should be renamed. IGOSS is mainly concerned with synoptic and semi-synoptic data, which fact could be referred to in the title. Further, reference to a "station system" seems to have led to misunderstandings. One solution would be to rename IGOSS simply WOW (World Ocean Watch). However, since the means and usefulness of IGOSS are now being re-considered elsewhere, this suggestion should not be considered a formal proposal.

The Committee noted with satisfaction that, during the Third Joint Session of the IOC Working Committee for IGOSS and the WMO Executive Committee Panel on Meteorological Aspects of Ocean Affairs (Geneva, 11 to 14 November 1970), a decision was taken to establish a Joint Ad Hoc Task Team for Determination of User Applications of Ocean Analyses and Prediction Services with emphasis on oceanographic aspects, that leadership of this Task Team was given jointly to the IOC Working Committee for IGOSS, the WMO EC-Panel and FAO, and that FAO's participation in this Task Team will relate both to the evaluation of the needs and potential benefits to fisheries from IGOSS and to the further planning of the system, taking into account fisheries research and operational requirements.

The Committee also made favourable reference to the Report of the ACMRR Working Party on Fishermen's Charts and Utilization of Synoptic Data (Suppl. 2 to the Report of the Fourth Session of ACMRR, FAO, Rome, 1967).

Furthermore, the Committee noted that the possible usefulness of IGOSS and its practicability have been discussed also at:

(a) The 58th Statutory Meeting of the ICES (Copenhagen, October 1970)

(b) The First Session of the IOC Group of Experts on Long-term Scientific Policy and Planning (Monaco, 16-25 November 1970)

(c) The Seminar on Methods of Detection, Measurement and Monitoring of Pollutants in the Marine Environment (Rome, 4-10 December 1970)

(d) The FAO Technical Conference on Marine Pollution and its Effects on Living Resources and Fishing (Rome, 9-18 December 1970)

Having discussed the fisheries requirements of IGOSS, and their practicability, the Committee commented on the System and allocated factors to the above-mentioned Task Team (and for an eventual insertion in the planned Prospectus for IGOSS) as follows:

The Committee was of the opinion that IGOSS, if properly developed into marine services, both using real-time approaches and preparing delayed-time summaries:

- for navigational purposes,
- for fishing operations,
- for marine science and fisheries research and management,
- for continuous surveying of the marine environment, including some appropriate elements of marine pollution,
- for flood-warning (storm surge) and coastal protection schemes,
- for long-term weather and oceanic predictions, etc.,

could play an increasingly useful role in the practical application of marine data and present scientific knowledge, it being understood that the oceanographic data can be complemented with meteorological data having bearing upon the sea-air inter-action.

The Committee recommended that the System development should be introduced stepwise, on the basis of present national and regional undertakings, within reasonable economical limits and with due attention to the appropriate user applications for oceanographic and other marine analyses and predictions.

The Committee noted that recently a great amount of useful preparatory work had been done for the introduction of IGOSS, including:

- development of some codes for reporting ocean parameters,
- preparation of a scheme to test the feasibility of exchange of BT data,
- work performed by the IOC Working Group on International Oceanographic Data Exchange,
- development of a preliminary draft convention on Ocean Data Acquisition Systems (ODAS) by the IOC Group of Experts on the Legal Status of ODAS, etc.

The Committee, having studied also the outline of the draft IGOSS Prospectus, as prepared by Dr. J.P. Tully, commended this important approach to all those concerned and suggested that the final version should be submitted for comment both to the collaborating Agencies, and to ICES and ICNAF as already arranged and to selected marine scientists and other individuals.

The observational work for IGOSS will be based upon the national and regional work presently under way. Also the other routine execution of the System must be performed mainly by the same centres while the problems of coordination will be solved by IOC and WMO. Nevertheless, an expanded international Secretariat is needed to deal with further planning and with the centralized (global) management aspects of the System. The Committee noted with satisfaction, the interest and suitability of IOC to be in charge of these new tasks and supported the view that it should expand its Secretariat to cope with the extensive work involved.

The Committee, while recognizing the service-oriented character of IGOSS, emphasized that every effort should be made, both in the planning and continuous execution of the System, to improve it further by using the latest understanding of oceanic processes and their inter-actions.

Furthermore, the Committee noted that the expanding production of synoptic descriptions and forecasts for the above fishery and other purposes would require continuous, active participation of fishery specialists, so that interpretation and presentation would be in a form most useful to fisheries. On the other hand, IGOSS, to be effective, would necessarily need observations to be made on board the fishing vessels (Cf. IOC/B-76, GELTSPAP I/17, para. 36). FAO should continue to assist with this through its contacts with national fishery agencies.

Finally, the Committee decided to establish a small Standing Group of experts to be designated by the Chairman, in consultation with the Secretary, to assist the FAO Fishery Resources Division by correspondence in the participation in IGOSS.

5.3 Training of Marine Scientists and Technicians

The Committee recalled its long-standing interest in this subject and noted that an ad hoc group had been maintained during the last session, which had been represented at the Joint Session of the IOC Working Groups on Education and Training in Marine Science and on Mutual Assistance (in Malta, 5-12 January 1971). It reviewed the Draft Report of the Joint Session as well as the recommendations concerning training and education adopted by the 12th Meeting of the IOC Bureau with the Consultative Council.

The Committee focussed its attention on education and training of marine scientists and particularly fishery research workers and technicians in developing countries. It wished to stress the discrepancy between the expected future needs for marine (including fisheries) scientists and technicians, and the present trends in international efforts relating to training and education. While noting the valuable work already done by FAO, it felt that the lack of increase of funds available for the training activities of both FAO and Unesco in these fields is particularly disturbing, as was pointed out in the report of the Malta meeting. The Committee noted with interest that an important developing Unesco educational activity involves the accelerated training of technicians. It was of the opinion that increased coordination and cooperation between FAO and Unesco, with respect to education and training of technicians, marine scientists and fishery research workers, should take place in order to take full advantage of available funds and professional expertise. The Committee therefore recommended that both Agencies should be requested to seek to increase their funds for training and education in marine (including fisheries) science from all possible sources, of which the UNDP, the IOC Trust Fund and bi/multilateral funds are thought to be most important.

The Committee endorsed the recommendation of the 12th Meeting of the IOC Bureau with the Consultative Council that new international activities concerning training and education in marine science and technology should, as far as possible, be located in developing countries, and emphasized the desirability of regionalization of such activities whether they be of a temporary or permanent nature. Regional fisheries bodies should be instrumental in organizing training activities supported by the Agencies and in securing common efforts by the groups of countries concerned.

The proposal for establishing national contact points for marine science training and education wherever feasible, was endorsed. It is thought that these contact points would be particularly useful for exchange of information concerning opportunities for short-term and sea-going training.

With reference to the preparation of a list of manuals, reference books, etc. recommended by the Malta meeting, the Committee proposed that its Secretary should circulate to all members a provisional list of selected references, based on the draft being prepared by the IOC Secretariat, requesting comments and additions. To increase its usefulness the list should be classified and abstracted, and in its preparation full use should be made of any existing compilations of this kind. While it is appropriate that the list covers all facets of marine science, FAO, with the assistance of ACMRR should ensure that its coverage of texts concerning fishery research specifically is adequate.

The Committee decided to maintain participation in the IOC Working Group on Training and Education through an ad hoc group of experts to be designated by the Chairman in consultation with the Secretariat.

6. INTERNATIONAL COORDINATION AND COOPERATION

6.1 Review of the Draft Plan of the Operational Phase of the Programme for the International Indian Ocean Fishery Survey (Under UNDP/FAO)

The Department of Fisheries had requested the Committee to review and comment on the Draft Plan of the Operational Phase of the Programme for the International Indian Ocean Fishery Survey. In order to implement this request the Committee established an Ad Hoc Working Party, which considered the matter in detail and submitted a full report; this was endorsed and transmitted to the Assistant Director-General (Fisheries) for action as required.

The Committee had several comments regarding the substantive character of the Draft Plan. These included the following:

(a) Summaries of on-going FAO/UNDP projects, national and bilateral activities and international work in the Indian Ocean should be incorporated in the report or made available to the Commission in another document.

(b) The recommendations concerning the nature of the productivity of mangrove swamp areas and the work proposed for ecological studies of coral reefs, might be drafted to be more definitive as regards their objective.

(c) There is need in the introduction to incorporate a section relative to the criteria that will be imposed in establishing priorities of work for the Indian Ocean development programme. This might include such items as need, national interest, relevance to overall Commission objectives, probability of success, cost, etc.

(d) A complete lack of commentary on oceanographic activities was noted. Some written statement should be incorporated, e.g. encouraging national or international oceanographic endeavour by academic institutions in the Indian Ocean during periods when surveys are planned. Such information could help to establish the environmental background for these important resources. This seems particularly desirable as large year-to-year variations in the hydrographic conditions occur in the Indian Ocean. Understanding of these variations may be helpful in forecasting variations in supply.

6.2 Collaboration with SCOR (Working Party on Biological Data Inventories; Working Party on Continuous Monitoring in Biological Oceanography; and Consultations on Freedom of Scientific Research in the Ocean)

6.2.1 The President of SCOR reported on activities of the Joint SCOR/ACMRR Working Groups. The Group on Monitoring in Biological Oceanography (SCOR WG.29) held its first meeting in May 1970. A final meeting is planned for early 1972 when, with the help of a few additional specialists, particular attention will be given to problems of patchiness in distribution of plankton. It is anticipated that the final report will be published by Unesco.

The Group on Biological Data Inventories (SCOR WG.32) met in April 1970. Their report was made available to the IOC Working Group on International Oceanographic Data Exchange which met in September 1970. Unfortunately, no member of the SCOR/ACMRR Group was able to attend. There was some discussion of the report, and a task team was established to develop an appropriate form for inventory of marine data and samples.

Dr. Colebrook had replaced Professor Hempel as Chairman of this SCOR/ACMRR Group. Arrangements for a second meeting were awaiting a review of the present status of the matter.

The Committee recommended that participation of the scientific advisory bodies in future meetings of the IOC Working Group on International Oceanographic Data Exchange be ensured, and requested the President of SCOR, in consultation with the Secretary of ACMRR, to expedite his enquiry into the status of the SCOR/ACMRR Group's activities and the need for further meetings of the Group.

6.2.2 As regards Freedom of Scientific Research, ACMRR had adopted during its Fifth Session (ACMRR: 5/5.2.3) recommendations on the facilitation of oceanographic research on the Continental Shelf. Interest in this question has since increased, especially because of discussions preliminary to the forthcoming Conference on the Law of the Sea. It was noted that SCOR had recently initiated an enquiry into the justifications for, and consequences of, restrictions on ocean research. The Committee agreed that objective studies of this nature would serve a useful purpose. For example, an historical essay might be prepared on the effect on scientific research of developments in the Law of the Sea. The Committee recommended that FAO, in preparing contributions for the Law of the Sea Conference, should keep the needs of scientific research in mind.

6.3 Other matters

Recalling the cooperation being maintained between ACMRR, SCOR of ICSU and, more recently, with ACOMR of WMO, both in general and as advisory bodies to IOC (as instanced by their collaboration in producing the Ponza Report "Global Ocean Research", and their share in organizing and participating in the GELTSPAP meeting), and further recalling various joint activities with SCOR, including the Joint Executive Meeting in Paris in 1970, the Committee reviewed the value of this collaboration in the light of the rapidly changing international scene (see item 4.1, page 4), and recommended that the Secretariat should make provision for further joint action with both or either of the other bodies, the need for and the nature of such action to be determined in the light of developing circumstances and in consultation with the Chairman.

APPENDIX 1

AGENDA

1. Procedural Matters
   - 1.1 Opening of the Session
   - 1.2 Adoption of the Agenda
   - 1.3 Date and Place of Seventh Session
   - 1.4 Election of Officers for the forthcoming period of activities

2. Implementation of Recommendations of the Fifth Session and other inter-sessional activities

3. Policy on Scientific Aspects of Fishery Resources Management and Development
   - 3.1 Scientific Advice to Fishery Management and Development Bodies
   - 3.2 Prerequisites for the application of a System Analysis Approach to Research and Management of Aquatic Resources
   - 3.3 Remote Sensors - Possible application to Fishery Resources and Environmental Research

4. FAO Programme of Work in the Field of Marine Resources and Environment
   - 4.1 Programme of Work for 1972/73 and Medium-Term Programme
   - 4.2 Survey and Charting of Fishery Resources
   - 4.3 Fish Egg and Larval Surveys
   - 4.4 Use of Submersibles and Underwater Habitats in Fishery Research
   - 4.5 Use of Acoustic Methods for Evaluation of Fishery Resources: Future requirements for the facilitation of Research and exchange of information in this field
   - 4.6 Duties and Functions of the FAO Fishery Data Centre
   - 4.7 World Appraisal of Fishery Resources: Updating of the Fishery Section of PSWAD and Follow-up Activities
   - 4.8 Improvement of Marine Resources and Mariculture, including Transplantation of Marine Organisms
   - 4.9 Follow-up of the FAO Technical Conference on Marine Pollution and its Effects on Living Resources and Fishing (1970), and of the Seminar on Methods of Detection, Measurement and Monitoring of Pollutants in the Marine Environment; Preparation for the UN Conference on Human Environment (1972); Application of Ecological Theory to Exploitation and Conservation of Marine Fishery Resources
   - 4.10 Scientific Information System on Aquatic Sciences and Fisheries

5. Matters Concerning the Inter-Governmental Oceanographic Commission (IOC)
   - 5.1 Planning and Implementation of the Long-Term Expanded Programme of Oceanic Research (LEPOR)
   - 5.2 Planning of the Integrated Global Ocean Station System (IGOSS) and Monitoring of the Marine Environment - Specific Requirements for Fishery Applications
   - 5.3 Training of Marine Scientists and Technicians
   - 5.4 Other matters

6. International Coordination and Cooperation
   - 6.1 Review of the Draft Plan of the Operational Phase of the Programme for the International Indian Ocean Fishery Survey (Under UNDP/FAO)
   - 6.2 Collaboration with SCOR (Working Party on Biological Data Inventories; Working Party on Continuous Monitoring in Biological Oceanography; and Consultations on Freedom of Scientific Research in the Ocean)
   - 6.3 Other Matters

7. Other business

APPENDIX 2

LIST OF INFORMATION PAPERS

ACMRR : 6/71/IP.1	Summary report on the activities of the FAO Fishery Resources Division in the field of marine resources research
ACMRR : 6/71/IP.2	Application of airborne remote sensing to fishery research and development and to fishing operations
ACMRR : 6/71/IP.3	Report of SCOR Working Group 32: Biological Data Inventories
ACMRR : 6/71/IP.4	Report of SCOR Working Group 29: Monitoring in Biological Oceanography
ACMRR : 6/71/IP.5	The role of FAO in the management of fishery resources
ACMRR : 6/71/IP.6	Fishery field programmes of FAO
ACMRR : 6/71/IP.7	Cooperation among international agencies in relation to fisheries
ACMRR : 6/71/IP.8 Suppl.1-6	Integrated Global Ocean Station System (IGOSS) As above
ACMRR : 6/71/IP.9	FAO statement on its possible contribution to preparations for the Conference on the Law of the Sea
ACMRR : 6/71/IP.10	Proposals for Medium-Term activities and general trends and organization of the work of FAO in the field of fisheries
ACMRR : 6/71/IP.11	2749(XXV) Declaration of Principles governing the sea-bed and the ocean floor, and the subsoil thereof, beyond the limits of national jurisdiction [Resolution adopted by the UN General Assembly (on the report of the First Committee (A/8097))]

APPENDIX 3

LIST OF WORKING PAPERS

ACMRR : 6/70/WP.1	Progress report of consultative group on the use of submersibles and underwater habitats in fisheries and related marine biological research
ACMRR : 6/70/WP.1 Suppl.1	As above
ACMRR : 6/71/WP.2	Introduction of exotic marine, euryhaline and anadromous organisms - a preliminary view - by L.A. Walford and R. Wicklund
ACMRR : 6/71/WP.3	Acclimatization of aquatic organisms in the U.S.S.R. - by A.R. Karpevitch
ACMRR : 6/71/WP.4	Report on the ACMRR Working Party on Fish Egg and Larval Surveys
ACMRR : 6/71/WP.5	Provisional Draft Agenda
ACMRR : 6/71/WP.6	Scope and operations of the FAO Fishery Data Centre
ACMRR : 6/71/WP.7	Scientific advice to fishery management and development bodies
ACMRR : 6/71/WP.8	FAO World Appraisal of Fishery Resources and follow-up of the fishery resource aspects of the Perspective Study of World Agricultural Development (PSWAD)
ACMRR : 6/71/WP.9	Application of ecological theory to exploitation and conservation of marine fisheries resources
ACMRR : 6/71/WP.10	Comprehensive outline of the scope of the Long-Term and Expanded Programme of Oceanic Exploration and Research (LEPOR)
ACMRR : 6/71/WP.10 Suppl.1	Group of Experts on Long-Term Scientific Policy and Planning (GELTSPAP)
ACMRR : 6/71/WP.11	Proposal for the establishment of an ACMRR Working Party on Aquaculture
ACMRR : 6/71/WP.12	Seminar on Methods of Detection, Measurement and Monitoring of Pollutants in the Marine Environment (FAO Technical Conference on Marine Pollution)
ACMRR : 6/71/WP.13	Conclusions and recommendations as approved (FAO Technical Conference on Marine Pollution and its Effects on Living Resources and Fishing)
ACMRR : 6/71/WP.14	ACMRR/CARPAS Working Party on the study of fishery resources in the Southwest Atlantic
ACMRR : 6/71/WP.15	Prerequisites for the application of a system analysis approach to research and management of aquatic resources - by Brian J. Rothschild
ACMRR : 6/71/WP.16	Acoustic techniques for fish detection and abundance estimation - by B.B. Parrish and L.M. Midttun
ACMRR : 6/71/WP.17 Rev.1	List of Working Papers
ACMRR : 6/71/WP.18 Rev.1	List of Information Papers
ACMRR : 6/71/WP.19	Provisional list of participants

ACMRR : 6/71/WP.20 Rev.1	12th Meeting of the Bureau with the Consultative Council
ACMRR : 6/71/WP.21	IOC, 12th Meeting of the IOC Bureau with the Consultative Council, Draft Report of the Joint Session of the Working Party on Training and Education in Marine Science and on Mutual Assistance
ACMRR : 6/71/WP.22	A plan for fishery development in the Indian Ocean - by J.C. Marr
ACMRR : 6/71/WP.23	Report of the Fifth Session of the ACMRR
ACMRR : 6/71/WP.24	Scientific information system on aquatic sciences and fisheries
ACMRR : 6/71/WP.25	Necessary conditions for the effective conduct of ocean research
ACMRR : 6/71/WP.26	ACMRR Working Party on the Methodology of Surveying and Charting of Fishery Resources
ACMRR : 6/71/WP.27	Programme of Work and Budget for 1972/73
ACMRR : 6/71/WP.28	Draft Report of the 6th Session of the Advisory Committee on Marine Resources Research
ACMRR : 6/71/WP.29	Preliminary note on policy concerning FAO species conference

APPENDIX 4

LIST OF PARTICIPANTS

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Mr. E.F. Akyüz	Senior Fishery Officer Fishery Resources Division
Dr. T.V.R. Pillay	Senior Fishery Officer (Aquaculture) Fishery Resources Division
Dr. H. Regier	Chief, Fish Stock Evaluation Branch
Dr. D. Sahrhage	Chief, Marine Biology and Environment Branch
Dr. W. Fischer	Fishery Biologist, Marine Biology Section Marine Biology and Environment Branch

Other staff members attended for discussions on certain items

Secretariat of the Committee

Secretary	Dr. M. Ruivo
Assisting the Secretary	Mr. E.F. Akyüz Dr. W. Fischer
Assistant	Mrs. R.M. Capparucci

APPENDIX 5

ADDENDUM TO AGENDA ITEM 3.3

Application of airborne remote sensing to fishery research and development, and to fishing operations

The Advisory Committee read with great interest, the document ACMRR:6/71/IP.2, on the above subject by W.H. Stevensen and J.H. Johnson, and listened to the supplementary information as provided by some members and, in particular, by Dr. Tomczak.

Remote sensing of the environment is now being extended also to the seas and oceans with sensing devices, measuring electromagnetic radiation, to include both aircraft and satellite-borne cameras, television, apparatus covering various spectrometric bands including those of ultraviolet and infra-red, radar, and radio frequency receivers.

The Advisory Committee, being of the definite opinion that the present stage and future development in handling and application of remote sensing data in relation to: fisheries research, fishing operations, and aspects of marine pollution, is bound to be of great significance, wishes to draw the attention of the FAO Fishery Resources Division to the following facts:

The advantages of remote sensing are the availability of data over the whole ocean on a real-time basis whereby frequent observations will provide synoptic pictures to trace variability of certain parameters in space and time. The real-time basis, as well as the wide coverage in area and time, makes remote sensing particularly valuable to assist pelagic fisheries in the open ocean and in certain coastal areas. This will also contribute to the comparison of productivity and its variations in certain areas.

It is, however, recognized that remote sensing has considerable short-comings. The price of the systems is rather high and ground resolution is still limited although sufficient for some purposes of fishery oceanography. The number of parameters measurable by the systems is limited and the penetration into the water column is small in most cases.

It is therefore understood that remote sensing cannot substitute major parts of conventional research in fisheries and environmental studies. However, it will become a useful additional tool for guiding fishing operations providing fisheries research with further information and assisting the monitoring of some aspects of marine pollution.

Since the main part of the living marine resources, harvestable at present, is to be found on the shelf, the use of aircraft, especially because of its much greater ground resolution, seems to offer the greatest possibilities. Nevertheless, it is expected that the real-time results from satellites covering vast areas of the oceans will grow in significance even in the application to the fishery interests, particularly in oceanic fisheries as for tuna. At present the airborne - both aircraft and satellite - remote sensing can be used for detection of the following features:

(1) Physical characteristics of the sea and weather for the conduct of fishing operations (warning systems)

(2) Physical characteristics of the environment of fish

(3) Spectrometry of the sea

(4) Location of fish schools

(5) Monitoring of fishing activities with a view to estimating fishing efforts and their locations

Moreover, the interrogation, recording and location sub-systems (IRLS), among others, for the measurements of currents, and other navigation methods, based upon the use of satellites, have already proved to be accurate and reliable.

It is expected that all these detection methods will become more accurate and more diversified in the future. Finally, it is also assumed that the multi-spectral or false-colour photography, i.e. the aerial photography with synchronized cameras using different colour filters, will prove most significant in the biological studies, including the monitoring of marine pollution.

The Advisory Committee is of the opinion that the airborne remote sensing of the seas and oceans will become increasingly important among others in the following fields:

(a) The application of satellite and/or aircraft information on the physical characteristics of the sea and weather for the conduct of fishing operations will probably be most valuable in providing scientists with the vast amount of oceanic and atmospheric real-time data needed for global analysis of ocean-atmosphere interaction. This will lead to improving man's capability in short and long-range weather and oceanic predictions. Moreover, the automatic picture transmission (APT), including the composite pictures of brightness, is now already giving important information, among others on the ice cover of the arctic and sub-arctic sea areas.

(b) In the study of the regional and spatial distribution of the marine environmental factors the infra-red radiometers have already proved applicable. When used on low flying aircrafts they give reliable information on the sea-surface temperature, in the areas of upwelling and of near-freezing conditions, important for fishing operations. Methods have been developed to overcome the difficulties of cloud coverage and to take into account the atmospheric water vapour, in order to obtain global sea-surface temperature data on a regular basis also from the satellites. By means of aerial photography, whenever necessary using multi-spectral cameras, reliable information is obtained on the coastal effects, including turbidity, over-fertilization and, in general, marine pollution.

(c) The spectrometry of the sea most probably will be developed further in the future. At present, the possibility of deploying a sensor to monitor chlorophyll-a from either an aircraft or satellite is quite exciting.

(d) Finally, it has already been shown that the fish schools near the surface can sometimes be located by means of aerial photography and, at least in some cases when the fish are at night near the surface, by means of bioluminescence triggered by schools. The laser method may offer interesting possibilities in increasing the depth range of air detection of fish concentration. The identification of species, however, requires further studies.

The use of satellites and aircraft to collect fisheries, oceanographic and meteorological data should not be considered independent of other programmes with the same objective, but rather supplementary to other programmes. The management of data from satellites and aircraft should be considered no more than part of a system of global, regional and local observation and data transmission networks now under development. These include programmes dedicated to the collection, analysis and dissemination of oceanic, meteorological and fisheries data, such as the Integrated Global Ocean Station System (IGOSS) and the World Weather Watch (WWW) now being established.

Because of the limited number of parameters, which can be observed by means of the airborne sensing methods, further special studies must be devoted to the understanding of the multiple correlations between the observed parameters and the behaviour of fish, and/or the location of fish schools, and of the marine pollution, in order to make the new rapid observations more useful.

Wherever experiments will become organized for the calibration of airborne remote sensors in areas of UNDP/SF fisheries projects of FAO relevant "ground-truth" data gathered by the FAO research vessels should be made available.

The Advisory Committee is of the opinion that the information now available on this subject, in the FAO Fishery Resources Division, should be distributed to all Member States, and in particular to those institutions either already connected with some aspects of such studies or possibly anxious to have knowledge of the present results and future prospects for the benefit of their own fishery operations and research.

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